

REMARKS/ARGUMENTS

A proposed amendment to Fig. 6 is enclosed herewith for the approval of the Examiner. The proposed amendment changes reference numeral 46, pointing to the top portion of the drain column 30, to 48 to avoid duplication of reference numerals, since 46 also labels one of the epitaxial layers in Fig. 6. Minor corrections have also been made to the specification, including a correction to conform the specification to amended Fig. 6.

Claims 1-12 were rejected under 35 U.S.C. §103(a) as being unpatentable over Hurkx et al., U.S. Patent No. 6,541,817, in view of Hadizad et al., U.S. Patent No. 6,756,273, and further in view of Ahlers et al., U.S. Patent No. 6,667,514. Reconsideration of the rejection is respectfully requested.

Independent claim 1 has been amended to provide, in part, that the semiconductor device comprises “a region of said second conductivity adjacent and lateral to each conductive column, said region being in charge balance with said conductive columns, and adjacent said channel region.” Independent claim 8 has been amended to provide, in part, that the semiconductor device comprises “a plurality of columns of said first conductivity each formed under and directly below a respective trench and extending between the bottom of said trench to said drain region, each column being spaced from another column by an adjacent and laterally disposed region of said second conductivity in charge balance with said plurality of columns.” Both independent claims 1 and 8 provide that each of the conductive columns located directly under or below a respective trench.

The Examiner indicates that “Hurkx et al. fail to disclose drain column regions directly below the trench and the required charge balancing structure,” (Office Action, page 2, paragraph 2, lines 9-10).

Hurkx et al. expressly provides that the regions 61 and 62 of the body portion 16 “each have a dopant content of their respective conductivity type that produces a balanced space charge in the body portion 16 when depleted in this off-state,” (column 4, lines 15-17) (emphasis supplied). The body portion 16, with its interposed first and second regions 61 and 62, is located adjacent to the lower part 20b of the trench 20, (column 4, lines 35-44; Fig. 1). Thus, a charge balancing structure disclosed in Hurkx et al. it is adjacent to the lower part of the trenches, not

underneath the bottom of the trenches. Applicant respectfully submits that one of ordinary skill in the art would not combine Hadizad et al. and Ahlers et al. to attempt to produce drain columns, located directly beneath the trenches, and adjacent regions charge balancing those drain columns, similar to the features in independent claims 1 and 8, since a charge balancing structure is already provided in Hurkx et al. adjacent to bottom portions of the trenches.

Since claims 2-7 and 9-12 are directly dependent upon one of claims 1 and 8, they are allowable over Hurkx et al. in view of Hadizad et al. and further in view of Ahlers et al. for the same reasons recited above with respect to the allowability of independent claims 1 and 8 over Hurkx et al. in view of Hadizad et al. and further in view of Ahlers et al.

Claims 13-17 were rejected under 35 U.S.C. §103(a) as being unpatentable over Hurkx et al. in view of Darwish, U.S. Patent Publication No. 2003/0102564, and further in view of Ahlers et al. Reconsideration of the rejection is respectfully requested.

Independent claim 13 has been amended to add a step in the “method for manufacturing a semiconductor device” of “forming regions of said first conductivity adjacent each said column of said second conductivity, said regions of said first conductivity being in charge balance with said columns of said second conductivity.” Since claim 16 is now redundant to amended claim 13, from which claim 16 depends, claim 16 has been canceled, without prejudice or disclaimer. As in independent claims 1 and 8, independent claim 13 provides that the conductive columns are formed below the trenches.

In his rejection of claims 13-17, the Examiner, similarly to his rejection of claims 1-12, states that, “Hurkx et al. fail to disclose the required drain column under the trench and the method, and the required charge balancing structure,” (Office Action, page 3, paragraph 3, lines 9-10). Based on the analysis of the Examiner with regard to claims 13-17, similar to the analysis with regard to claims 1-12, the comments made above with respect to independent claims 1 and 8, insofar as they relate to Hurkx et al. and Ahlers et al., apply equally here.

With regard to Darwish, according to the Examiner, that reference “discloses a trench MOSFET having implanted drain-drift region and process for manufacturing the same where the required drain column region is under the trench as shown in Fig. 18 and method,” (Office Action, page 3, paragraph 3, lines 11-13). Applicant respectfully submits that there would be no

reason for one of ordinary skill in the art to combine any drain column region under the trench as shown in Fig. 18 in Darwish with Hurkx et al., when Hurkx et al. already has charge balancing structure adjacent to the bottom portion of each trench, as previously stated.

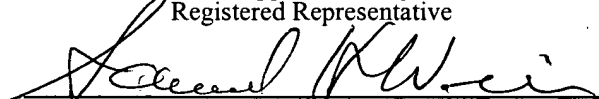
Since claims 14-17 are directly or indirectly dependent upon independent claim 13, they are allowable over Hurkx et al. in view of Darwish and further in view of Ahlers et al. for the reasons recited above with respect to the allowability of independent claim 13 over Hurkx et al. in view of Darwish and further in view of Ahlers et al.

In view of the foregoing remarks, the allowance of claims 1-15 and 17 is respectfully requested.

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on June 13, 2005:

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Name of applicant, assignee or
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Signature

June 13, 2005

Date of Signature

Respectfully submitted,



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